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EXAMINER
LANDAU, MATTHEW C

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 02/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/055,211	YEDINAK ET AL.	
	Examiner	Art Unit	
	Matthew Landau	2815	

-- Th MAILING DATE of this communication app ars on th cover sh et with th correspondenc address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-42 is/are pending in the application.

4a) Of the above claim(s) 3,6,7,9,24,33 and 39 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1,2,4,5,8,10-23,26-32,34-38 and 40-42 is/are rejected.

7)☒ Claim(s) 25 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 21 May 2002 is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Species V, as shown in Figure 14, in Paper No. 6 is acknowledged.

A quick review of the drawings reveals that claims 6 and 9 are drawn to a nonelected species. Therefore, claims 3, 7, 24, 33, and 39 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 6.

Drawings

Figures 4A, 4B, 4C, 4D, 5 and 6 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance. Furthermore, it is unclear if the embodiments shown in Figures 7 and 8 should be considered prior art. Applicant's statement, "No admission is made in this application that Figs. 7 and 8 are, per se, prior art" is acknowledged. However, certain aspects of the disclosure suggest otherwise. For example, see page 3, lines 17-32. In order to properly determine patentability of the claimed invention, Applicant should distinctly state for the record whether or not Figures 7 and 8 are prior.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the following features must be shown or the feature(s) canceled from the claim(s): a plurality of base regions, a plurality of base stripes, base stripes connected together to form a common base, portions of the body region extending between opposite ends of sequential source stripe segments, and the source segments having different lengths. No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

The disclosure is objected to because of the following informalities: both the gate strip and the source segment are referred to as reference number 2 (see page 8, lines 1-10).

Appropriate correction is required.

Claim Objections

Claims 1, 11, 13, 20, 28, 31, and 34 are objected to because of the following informalities:

In regard to claim 1, there is insufficient antecedent basis for "the length", "the one surface", "the nearest border", "the same direction", and "the edges".

In regards to claim 11, the claim should be cancelled since it is a duplicate of claim 8.

In regards to claim 13, there is insufficient antecedent basis for "the center".

In regards to claim 20, there is insufficient antecedent basis for "the border".

In regards to claim 28, there is insufficient antecedent basis for "the surface", "the inside surface", and "the outside surface". Furthermore, the claim should end in a period.

In regards to claim 31, the claim is indicated as depending for claim 26. It appears that Applicant intended to have the claim depend from claim 28. For the purposes of this Office Action, the claim will be treated as if it depends for claim 28.

In regards to claim 34, there is insufficient antecedent basis for "the heads" and "the tails".

In regards to claim 40, the claim should be cancelled since it is a duplicate of claim 34.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1, 2, 4, 5, 8, 10-19, 21, 22, 28-32, 34, 36, 41 and 42 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In regards to claim 1, the limitation "an insulating layer over the conductive gate stripes and covering the edges of the source stripes proximate the body stripe" renders the claim

indefinite. It is unclear what is meant by "the edges". If "the edges" refers to the junction between the source stripe and the base region, it is unclear how the insulating layer covers the edge since the edge is within the base region. For the purposes of this Office Action, it is considered that "the edges" can be any point along the junction of the source stripe and the base region.

In regards to claims 5, 22, 31, and 38, it is unclear how the base stripes/regions are connected together.

In regards to claim 13, the limitation "wherein the length of the source segment depends upon its proximity to the center of the IGBT" renders the claim indefinite. Is the source segment longer or shorter the closer it gets to the center? What is the center?

In regards to claim 14, the limitation "wherein the length of the source segment depends upon a desired local SCIS current density" renders the claim indefinite. The relationship between source segment length and current density is unclear. Does Applicant intend to claim the source segment length increases/decreases as a local SCIS current density increases/decreases? It is also unclear how a relationship between the source segment length and a "desired" current density structurally distinguishes the claimed invention.

In regards to claim 21 and 36, it is unclear how spacing apart the source contact regions provides the resistances.

In regards to claim 28, the limitation "each base region divided by the gate trench" renders the claim indefinite. It is unclear how more than one base region is divided by one gate trench. For the purposes of this Office Action, it is considered there is one base divided by one gate.

In regards to claim 41, it is unclear how the gate can be both a planar gate on the surface and a trench gate as set forth in claim 28, from which this claim depends.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 20, 26, and 35 are rejected under 35 U.S.C. 102(b) as being anticipated by Korman et al. (US Pat. 5,119,153, hereinafter Korman).

In regards to claim 20, Figure 1 of Korman discloses an insulated gate bipolar transistor device (IGBT) comprising: a substrate heavily doped with a first dopant of one polarity (column 5, lines 19-27); a drift layer 116 over the substrate and doped with a second dopant of an opposite-polarity, the drift layer extending to a surface opposite the substrate; base regions 118 doped with the first dopant, each base region bordered by the drift layer and each base region extending along a length of the surface to form a plurality of base stripes on the surface of the device; source stripes 120 with second dopants in the base regions proximate the border of the base regions to form channel regions extending from the source stripes to the proximate border of the drift layer and the base stripe; an insulated control gate 131 over the base regions, between the source stripe and the drift layer and over the channel regions; and source contact regions 158

disposed adjacent the source stripes. It is inherent that there is some resistance between the source contact regions and the source stripes. The intended use limitation "for constricting the flow of electron current between the drift layer and the source contact regions" does not structurally distinguish the claimed invention.

In regards to claim 26, Figure 1 of Korman discloses the first dopant is p-type and the second dopant is n-type.

In regards to claim 35, Figure 1 of Korman discloses an insulated gate bipolar transistor device (IGBT) comprising: a substrate heavily doped with a first dopant of one polarity (column 5, lines 19-27); a drift layer 116 over the substrate and doped with a second dopant of an opposite polarity, the drift layer extending to a surface opposite the substrate; base regions 118 doped with the first dopant, each base bordered by the drift layer and extending along a length of the surface to form a plurality of base stripes on the surface of the device; two source stripes regions 120 disposed inside each base stripe, the source stripe regions shallower than the base for forming channel regions at a junction of the base stripe and the source stripe; source contact regions 158 extending between the base regions and the source stripes; an insulating layer 164 covering the source stripes and having vias above the source contact regions; a source contact layer 134 over the source stripes and in the vias for contacting the source contact regions; a gate 131 including a gate insulator 130 and conductive material 132 adjacent the gate insulator forming the gate electrode, said gate disposed over the channel region formed by the base and source stripes. It is inherent that there is some resistance between the source contact regions and the source stripes.

Claims 28 and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by the admitted prior art.

In regards to claim 28, as best the examiner can ascertain the claimed invention, Figure 4B of the instant application discloses an insulated gate bipolar transistor device (IGBT) comprising: a substrate 9 heavily doped with a first dopant of one polarity; a drift layer 5 over the substrate and doped with a second dopant of an opposite polarity, the drift layer extending to a surface opposite the substrate; a trench gate 19 in the surface of the drift layer including a gate insulator 17 on the inside surface of the trench and a conductive material 19 adjacent the gate insulator forming the gate electrode; base region 3 doped with the first dopant, the base region divided by the gate trench, bordered by the drift layer and extending along a length of the surface to form a plurality of base stripes on the surface of the device; source stripe regions (2a and 2b) disposed between the base stripes and the trench and shallower than the base for forming channel regions along the outside surface of the trench; and source contact regions (area contacted by layer 23) extending between the base regions and the source stripes. It is inherent that some resistance exists in the source stripes and disposed between the source contact regions.

In regards to claim 29, Figure 4B of the instant application discloses a insulating layer 21 over the trench gate 19 and over source stripe regions (2a and 2b); a plurality of vias in the insulating layer and over the source contact regions; a source contact layer 23 over the insulating layer and extending through the vias therein to contact the source contact regions in the source stripes.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 4, 8, 11, 13, 14, 17, 18, 20, 21, 23, 26, 35, 36, and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over the admitted prior art in view of Kuwahara et al. (US Pat. 6,060,744, hereinafter Kuwahara).

In regards to claim 1, as best the examiner can ascertain the claimed invention, Figures 4A, 4D, and 5 of the instant application disclose an insulated gate bipolar transistor device (IGBT) comprising: a substrate 9 heavily doped with a first dopant of one polarity; buffer and drift layers (7 and 5) doped with a second dopant of a polarity opposite to the first dopant, the buffer and drift layers located over the substrate, with the drift layer extending to a surface opposite the substrate; a base region 3 doped with the first dopant, the base region bordered by the drift layer, and the base region extending along the length of the surface to form a base stripe 3 on the one surface of the device; first and second source stripes (2a and 2b) doped with the second dopant and located in each base stripe, the source stripes being parallel to each other and extending in the same direction as the base stripes, the source stripes spaced from each other to define a body stripe 3b between the source stripes and spaced from edges of the base stripe to define first and second channel regions (30a and 30b) extending in opposite directions across opposite edges of the base stripes from each of the source stripes to the nearest border of the drift layer; a gate oxide stripe 17 over the channels on the surface and a conductive gate stripe 19 on

the gate oxide stripe for controlling current through the channels; an insulating layer 21 over the conductive gate stripes and covering the edges of the source stripes proximate the body stripe; a source contact layer 23 extending through the insulating layer at a location between opposite gate stripes; a plurality of source contact regions 20 heavily doped with the second dopant, disposed in the body stripe and extending from the body stripe to at least one of the source stripes and in electrical contact with the source contact layer. The difference between the admitted prior art and the claimed invention is a plurality of base regions. Figure 6 of Kuwahara discloses an IGBT with a plurality of base regions 2. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of the admitted prior art by including a plurality of base regions for the purpose of increasing the capacity of the device.

In regards to claim 2, Figure 5 of the instant application discloses source contact regions (20a and 20b) which extend from the body stripe in opposite directions to each source stripe.

In regards to claim 4, Figure 6 of the instant application discloses the source stripes are divided into a plurality of elongated source segments spaced from each other along opposite sides of the body stripe, and portions of the body region extending between opposite ends of sequential segments to separate the sequential source stripe segments from each other.

In regards to claims 8 and 11, Figure 6 of the instant application discloses the source segments are the same length.

In regards to claim 13, as best the examiner can ascertain the claimed invention, Figure 6 of the instant application discloses the length of the source segment depends upon its proximity to the center of the IGBT.

In regards to claim 14, as best the examiner can ascertain the claimed invention, Figure 6 of the instant application discloses the length of the source segment depends upon a desired local SCIS current density.

In regards to claim 17, Figure 4D of the instant application discloses the doping concentration in the source stripes 2 is less than the doping concentration in the source contact regions 20.

In regards to claim 18, Figure 4A of the instant application discloses the first dopant is p-type and the second dopant is n-type.

In regards to claim 20, Figures 4A, 4D, and 5 of the instant application disclose an insulated gate bipolar transistor device (IGBT) comprising: a substrate 9 heavily doped with a first dopant of one polarity; a drift layer 5 over the substrate and doped with a second dopant of an opposite polarity, the drift layer extending to a surface opposite the substrate; a base region 3 doped with the first dopant, the base region bordered by the drift layer and each base region extending along a length of the surface to form a base stripe 3 on the surface of the device; source stripes 2 with second dopants in the base region proximate the border of the base region to form channel regions 30 extending from the source stripes to the proximate border of the drift layer and the base stripe; an insulated control gate 19 over the base regions, between the source stripe and the drift layer and over the channel regions; and source contact regions disposed adjacent the source stripes. It is inherent that some resistance exists between the source contact regions and the source stripes. The intended use limitation "for constricting the flow of electron current between the drift layer and the source contact regions" does not structurally distinguish the claimed invention over the prior art. The difference between the admitted prior art and the

claimed invention is a plurality of base regions. Figure 6 of Kuwahara discloses an IGBT with a plurality of base regions 2. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of the admitted prior art by including a plurality of base regions for the purpose of increasing the capacity of the device.

In regards to claim 21, Figure 5 of the admitted prior art discloses the source contact regions 20 are spaced from each other along the length of the source stripes 2 to connect opposite stripes to each other only at spaced apart locations and thereby provide the resistances.

In regards to claim 23, Figure 6 of the admitted prior art discloses the source stripes 2 are sequentially segmented and sequential segments are separated from each other by the base region 3.

In regards to claim 26, Figure 4A of the instant application discloses the first dopant is p-type and the second dopant is n-type.

In regards to claim 35, Figures 4A, 4D, and 5 of the instant application disclose an insulated gate bipolar transistor device (IGBT) comprising: a substrate 9 heavily doped with a first dopant of one polarity; a drift layer 5 over the substrate and doped with a second dopant of an opposite polarity, the drift layer extending to a surface opposite the substrate; a base region 3 doped with the first dopant, the base region bordered by the drift layer and extending along a length of the surface to form a base stripe 3 on the surface of the device; two source stripe regions 2 disposed inside the base stripe, the source stripe regions shallower than the base for forming channel regions 30 at a junction of the base stripe and the source stripe; source contact regions extending between the base region and the source stripes; an insulated layer 21 covering the source stripes and having vias above the source contact regions; a source contact layer 23

over the source stripes and in the vias for contacting the source contact regions; a gate 19 including a gate insulator 17 and conductive material 19 adjacent the gate insulator forming the gate electrode, said gate disposed over the channel region formed by the base and source stripes. It is inherent that some resistance exists between the source contact regions and the source stripes. It is inherent that some resistance exists between the source contact regions and the source stripes. The difference between the admitted prior art and the claimed invention is a plurality of base regions. Figure 6 of Kuwahara discloses an IGBT with a plurality of base regions 2. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of the admitted prior art by including a plurality of base regions for the purpose of increasing the capacity of the device.

In regards to claim 36, Figure 5 of the admitted prior art discloses the source contact regions 20 are spaced from each other along the length of the source stripes 2 to connect opposite stripes to each other only at spaced apart locations and thereby provide the resistances.

In regards to claim 37, Figure 6 of the admitted prior art discloses the source stripes 2 are sequentially segmented and sequential segments are separated from each other by the base region

In regards to claim 19 and 27, the difference between the admitted prior art and the claimed invention is the first dopant is n-type and the second dopant is p-type. Kuwahara discloses the conductivity type of the various regions can be n-type or p-type (column 11, lines 22-24). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of the admitted prior art by switching the conductivity types since this practice is well known in the art.

Allowable Subject Matter

Claim 25 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 5, 10, 12, 15, 16, 22, 30, 31, 32, 34, 38, and 42 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Iwamuro discloses an IGBT with plurality of source stripes in base regions. Bhalla et al. discloses resistors in a base regions.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (703) 305-4396.

The examiner can normally be reached from 8:00 AM-4: 30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or

proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Matthew C. Landau

Examiner

February 3, 2003

EDDIE LEE
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